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ABSTRACT

An analysis of stress and intonation patterns in Swedish is presented in the context of lexical phonology. The theories of lexical, metrical, and autosegmental phonology are outlined, and a brief review of Swedish stress and tone patterns is presented. The nature of Swedish stress, the interaction of stress rules with length and morphology, the representation of tone accents, and the interaction of stress, tone accent association, and morphology in Swedish are examined and illustrated. (MSE)

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Non-linear Analyses of Swedish Stress and Tone

To be presented on December 30, 1986, at LSA, New York

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0. Introduction and overview

This is an analysis of Swedish word prosody in the framework of Lexical Phonology. The presentation is structured as followed:

1.0. Theoretical frameworks
1.1. Outline of Lexical Phonology (Mohanan 1986; Kiparsky 1982; Pulleyblank 1986)
1.2. Metrical Phonology (Hayes 1980)
1.3. Autosegmental Phonology (Pulleyblank 1986)

2.0. Stress and tone accents in Swedish

3.0. Metrical stress rules in Swedish (interaction with length)

4.0. Autosegmental representation of tone accents in Swedish

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1.0. Theoretical frameworks

1.1. Lexical Phonology

My analysis is set within Lexical Phonology. Swedish word prosody lends itself to a lexical analysis because it is highly dependent on morphological processes, as we shall see below. Following Mohanan & Mohanan (1984), Mohanan (1986) and Pulleyblank (1986), I assume the following model of Lexical Phonology. [1]

(1) (a) There is a dichotomy of word and sentence structure.

(b) Rules are assigned to strata (domains) of applications.

[1] Lexical phonology is the product of many minds, starting with Halle (1973), Siegel (1974), Allen (1978), among others, for morphological processes. Pesetsky (1979), Mohanan (1982), Halle & Mohanan (1985), Kiparsky (1982a,b) and others have developed the phonological side. I cannot do justice to all the work undertaken within Lexical Phonology in the space allotted here.

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(c) One rule may be assigned to several (continuous) strata.

(d) Cyclicity is a property of particular lexical strata, not of rules.

(e) Lexical rules are located on cyclical strata, post-lexical rules are not.

(f) A new cycle begins when a new morphological form is added.

(g) Non-cyclic rules apply after all morphological operations have applied.

(h) Cyclic rules obey strict cyclicity which means that a new morphological form must be added before phonological rules can apply. Structure-building rules like foot formation rules are exempt from Strict Cyclicity (Kiparsky 1982).

(i) Bracket Erasure applies at the end of every stratum (Mohanan 1982; Kiparsky 1982a).

Preliminarily, I assume that there are three lexical strata in Swedish, two for derivative processes, and one for compounding.

1.2. Metrical Phonology

I am following Hayes (1980)[2] in assuming that Metrical Phonology has the following properties:

(2) (a) Individual stress rules are regarded as restrictions on the most basic tree construction principle: Metrical trees construct the largest tree compatible with their conditions.

Each language has

(b) a limited number of tree geometries;

[2] Hayes (1980) is, of course, an elaboration of work by Liberman & Prince (1977), Selkirk (1980), Kiparsky (1979) and others.

(c) a limited number of possible labeling procedures, the labels (s) and (w) being distributed to the syllable, the foot and the word.

(d) a specific number of separate levels of metrical structure.

(e) a direction in which feet are constructed by iterative rules (Hayes 1981: 15).

Swedish has the following word and foot tree construction rules.

(3) Word[3]: In the configuration N_1, N_2, always label N_2 as strong iff it branches. Heavy final syllables count as branching. Otherwise, N_1 is strong. N_1 is always strong in compounds consisting of free morphemes.

(4) Foot: Assign maximally binary (s-w) feet from right to left, where (w) may not branch in the environment _] (Kiparsky 1982b: 166).

2.3. Autosegmental Phonology

Following Pulleyblank (1986), I assume a revised version of Goldsmith's (1976) original **Association Convention**[4]

(5) (i) Association between tone-bearing elements and tones takes place from left to right, in a one-to-one relation. Multiple linkings to tones or to tone-bearing units are possible, but strictly language-specific.

(ii) Association lines may not cross.

(iii) Reapplication of the Association Convention is automatic, unless delinking rules have applied.

(iv) Spreading of autosegments is *not* automatic.

Furthermore, the following claims with regard to **Underspecification** (Kiparsky 1982a: 54) are accepted:

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[3] Adapted from Liberman & Prince (1977: 308): the Lexical Category Prominence Rule.

[4] Similar claims were made by Williams (1971), Clements & Ford (1979), and Halle & Vergnaud (1982).

(6) (i) Lexical entries are underspecified.

(ii) Unspecified values for features are filled in by rules supplied by UG or by language-specific grammars.

(iii) For every feature F, there is a rule [ ] -> [αF].

For Autosegmental Phonology this translates into the following claims:

(7) (i) A language may choose to implement the **default values** for one or both tonal features supplied by UG. The universal default tonal value is [+LOW].[5]

(ii) A language can select the component [i.e. stratum] in which default tonal rules begin their application.

(iii) Default rules cannot be extrinsically ordered (Pulleyblank 1986:24).

Before we procede to the analysis of stress and tones in Swedish, I will give a short outline of the manifestation of stress and tone in Swedish.

2.0. Stress and tone in Swedish

2.1. Stress

In contrast to Jensen (1980a) I shall assume that stress assignment in Swedish is not free. I will argue that stress in Swedish is crucially dependent on the internal syllable structure. My claim is that Swedish obeys a form of the Latin stress rule. Swedish has a large number of non-initially stressed words which have been fully integrated in the language through the centuries. Non-initially stressed loanwords originate from German (e.g. verbs with unstressed suffixes as in betala 'pay'), French (fåtölj 'armchair'), Latin (akvarium) and Greek (matematiker 'mathematician'). Words that can

[5] As established by Pulleyblank (1986; Chapter 4).

be traced back to Old Norse (here referred to as native) are generally stressed on the first syllable.

Linear stress analyses

A number of treatments of Swedish stress phenomena within a generative, linear framework exist, among others, Linell et al. (1971), Elert (1967), Witting (1977), and Jensen (1980a). Witting holds that lengthening is present prior to stress, Jensen has a stress rule that stresses the root. Native stress patterns are derived with a retraction rule. Borrowings are often treated as exceptions. The high post-stress pitch of Accent 2 words is incorrectly treated as a stress. Witting (1977) and Elert (1970) find that the Compound rule is not adequate for handling compound stress in Swedish. Moreover, the function of Accent 2 (see next section) is only marginally dealt with in these SPE-like treatments. I will attempt to show that stress phenomena for simple words and compounds can be more adequately described within a metrical framework that takes into account the relational nature of stress. Furthermore, the point is made in SPE that the Compound rule is cyclic. However, it can be shown that there is no separate compound rule, but that we are in fact dealing with the same stress rules in simple words and compounds alike. The strict cyclicity constraint is an inherent part of Lexical Phonology and most of the problems addressed above can be solved by letting certain strata be cyclic and others not. Lexical Phonology also allows us to integrate morphological information.

2.2. Tone accents

Together with a handful of other Indo-European languages, Swedish has tone accents. These are morphophonologically determined changes in the pitch contour, which are phonemic (albeit in about 350 minimal pairs, but there is a fair number of near-minimal pairs). In words with two or more syllables, either Accent 1 or Accent 2 is possible; the actual occurrence is morphophonologically determined. Accent 1 will be represented as (´) on the stressed syllable and Accent 2 as (`). (ˈ) represents secondary stress.
In constrast, the two tone accents look as follows.

(8)

Accent 1	Accent 2
and-en	ˈande-n
'duck-the'	'spirit-the'

(Stylized Fo contours, following Gårding 1977).

It is shown that Accent 2 stretches over at least two syllables, while Accent 1 also can be found on monosyllabic word, as well as in words which are stressed on the last syllable. Bruce (1977) has shown that the basic contour for Accent 1 words is LH, where L coincides with the stressed syllable. The contour for Accent 2 words is HLH, where the first H is associated with the primary stressed syllable and the second H is associated with the last syllable which contains secondary stress. The rules governing tone accent distribution are extremely complex and full of exceptions, but my goal here is to account for the following regularities.

(9) Word and Accent Types[6]

Accent 1

Initially stressed

(a)nouns with monosyllabic stems. Definite article suffixes (-en, -et,) do not change the accent (bíl-en 'car-the').

(b) Present tense verbs ending in -er (ring-er 'calls').

(c) Adjectives ending in -sk (mʼystisk 'mysterious').

II. Finally stressed

(a) nouns: allé 'alley', maskín 'machine', fabrikatión 'manufacturing', demokratí 'democracy', bageri 'bakery'.

(b) adjectives: intensív 'intensive', manuéll 'manual', akút 'acute'.

III. Penultimately stressed

(a) verbs of Latin origin ending in -éra: passéra 'pass', socialisera 'socialize', intresséra 'interest v.'.

(b) nouns of Latin origin ending in -éring: socialisering 'socialization.'

(c) adjectives of Latin origin ending in -ábel: presentabel 'presentable'.

(d) nouns of Latin origin ending in -ium (i-› y): laboratórium 'laboratory', akvárium 'aquarium'.

IV. Nouns stressed on the antepenult: matemátiker 'mathematician', politiker 'politician' (cf. politik, matematik).

V. Compounds not analyzed as transparent compounds: days of the week (onsdag 'Wednesday'), kinship terms (mormor 'grandmother' ("mother's mother")).

VI. Verbs with (German) prefixes for-, be-: fordela (cf. dela) 'distribute', betala (cf. tala) 'pay'.

Accent 2

Initially stressed

VII. (a) Nouns with bisyllabic stems: flicka 'girl', huvud 'head', senap ' mustard'.

(b) Verbs with bisyllabic stems: kàlla(r) 'to call' ('calls'), kàllade 'called'.

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[6] Orthographical representation, enhanced with tone accents.

VIII. (a) Nouns with monosyllabic stems ending in -ing, -dom etc.: mening 'sentence'.
(b) verbs with monosyllabic stems and past tense ending -te, -de: kö`pte 'bought', ringde 'called'.
(c) nouns with monosyllabic stems and plural suffix -ar: bilar 'cars'. (Accent shift).

IX. (a) Adjectives ending in -bar, -sam, -full, -ig, -vis (a`tbar 'edible', hjalpsam 'helpful', lèkfull 'playful', ròlig 'funny', frå`gvis 'inquisitive'.
(b) Adverbs ending in -vis, -en: mo`jligen, mo`jligtvis 'possibly'.

X. "Feminine" nouns ending in -ska, -inna, -èssa: skö`terska 'nurse', doktorinna 'doctor's wife', prinsèssa 'princess'.

XI. Compounds mostly carry Accent 2.

In structuralist and SPE accounts, the rules for these different patterns of accent distribution have been very complex (see, for instance, the rules in Elert (1972, 153; 157). Jensen (1980a) has a theme stress rule which incorrectly stresses the post-stress syllable in bisyllabic Accent 2 words. We have a H pitch, but not necessarily a stress. This is particularly undesirable with repsect to certain dialectal manifestations of Accent 2, namely those dialects which have one peak late in the first syllable in Accent 2 words (e.g. Scanian). Let us assume that thematic vowels do not carry secondary stress, but compounds do.

In the third and fourth sections of this presentation, the following issues will be dealt with.

(3.1.) What is the nature of Swedish stress?

(3.2.) How do stress rules interact with length (and other phonological rules)?

(3.3.) How do stress rules interact with the morphology?

(4.1.) How are tone accents represented in Swedish?

(4.2.) How do stress, tone accent association and the morphology interact in Swedish?

3.0. Metrical stress rules in Swedish

In previous papers (Schmid 1985, 1986b), I claimed that Swedish has three stress rules: one for the "native" stress pattern, one for foreign borrowings, and one retraction rule. Within the framework of Lexical Phonology, however, it turns out that Swedish stress is much simpler, with one stress rule only.

3.1. Stress rule(s) in Swedish

The final form of the Swedish is shown in (4) above and on the handout. (4) replaces the "Foreign Stress Rule" and the Retraction Rule. The argument is as follows: The original assumption was that there are three stress rules, the FSR (10), the MSR (11), and the RR (12).

(10) (a) Build a foot at the right edge of a word if the final syllable is heavy or marked for stress. Heavy syllables end in VC. (b) If the final syllable is not heavy, build a binary, quantity-sensitive foot, starting on the right edge of the word. Right-dominant word tree. This rule would precede the Main Stress Rule.

(11) Main stress rule: Form a binary, quantity-sensitive foot on the rime projection[7] at the left edge of the word, with the left node dominant.

(12) The Retraction rule goes for right to left, building left dominant binary feet. It is quantity-insensitive.

[7] The part of the syllable that stress rules pay attention to. If the rime is branching, we expect a strong node. English has branching rimes of the structure VC and VV; Swedish only has VC, because vowel lengthening takes place after stress rules have applied. Thus, Swedish is only partly quantity-sensitive (like Italian; Chierchia 1984).

Sample derivations:

(13a)

flikka	'girl'	
ik a	Rime projection	
s w	Main Stress	
\/	Word tree	

(b)

tala	'speak'	
a a	Rime projection (RP)	
s w	Main Stress	
\ /	Word tree	

(c)

betala	'pay'	
e a a	RP	
w s w	Main Stress	
\ \/	Other rules	
\ s		
\/		

(d)

avbetala	'pay off'	
a e a a	RP	
s w s w	Main Stress	
\/ \/	Other rules	
s w		
\/		

(14a)

flikka	'girl'	
ik a	RP	
s w	Main Stress or FSR?	
\/	Word tree	

(b)

passéra	'pass' v.	
a e a	RP	
w s w	FSR or Main Stress?	
\ \/	Word tree, Other rules	
\ s		
\/		

(c)

presentábel	'presentable'	
e e a e	RP	
s w	FSR or MSR	
\/		
e e a e		
s w s w	Retraction	
\/ \/		
w s	Word tree	

(d)

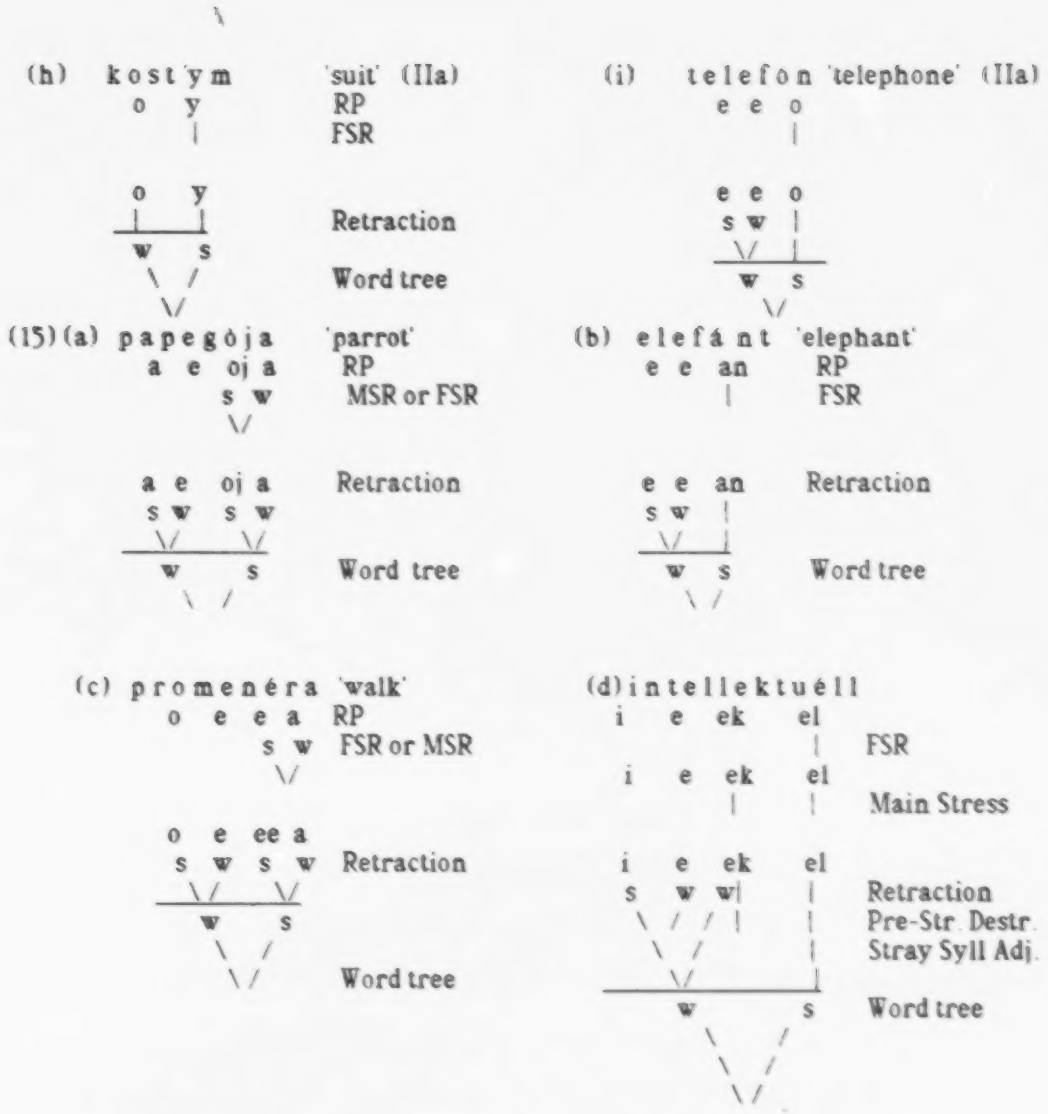
laboratórium	'laboratory'	
a o a ur u	RP	
s w	FSR or MSR	
\/		
a o a ur u		
s w | s w	Retraction (see below)	
\/ \ /		
a o a ur u		
s w w s w	Other rules, Word tree	
\/ / \ /		
\/ \/		
w s		
\ /		
\/		

(f)

intelligént	'intelligent'	
i el i en	RP	
|	FSR	
i el i en		
|w s w |	Retraction (see below)	
\ \/ |		
\ w s	Word tree	
\ \ /	Other rules	
\ \/		
\ s		

(g)

resonáns	'resonance'	
e u an		
|		
e u an		
s w |		
\/ |		
w s		
\ /		
\/		


(h) k o s t' y m 'suit' (IIa)
o y RP
FSR
o y
Retraction
w s
Word tree
(i) t e l e f o n 'telephone' (IIa)
e e o
e e o
s w
w s
(15) (a) p a p e g ò j a 'parrot'
a e oj a RP
s w MSR or FSR
a e oj a Retraction
s w s w
w s Word tree
(b) e l e f á n t 'elephant'
e e an RP
FSR
e e an Retraction
s w
w s Word tree
(c) p r o m e n é r a 'walk'
o e e a RP
s w FSR or MSR
o e ee a
s w s w Retraction
w s
Word tree
(d) i n t e l l e k t u é l l
i e ek el
FSR
i e ek el
Main Stress
i e ek el
s w w Retraction
Pre-Str. Destr.
Stray Syll Adj.
w s Word tree

A closer look at these stress rules and the sample derivations in (13, 14, and 15) reveals a number of redundancies. A native word like flicka 'girl', for example could be derived with the MSR and also with the FSR. In spite of a certain intuitive appeal of a native stress rule which applies from left to right, I opt to eliminate the original MSR, and keep the FSR, but rename it MSR, since that is the purpose it now has. Furthermore, the RR only differs from the other two rules by virtue of being quantity-insensitive. Since

quantity-sensitivity is not an important issue in Swedish stress rules anyway (see footnote 7), stress rules need not refer to it. As shown in (4), it is not explicitly referred to in the final stress rule. For English, Kiparsky (1982b) has argued that the RR becomes superfluous when placed within Lexical Phonology. Kiparsky found that the MSR is a special case of the RR. In accordance with the Elsewhere Condition, the rules must apply disjunctively if "the subset of A [=MSR] is a proper subset of the input to B [=RR]." Furthermore, if these rules both are cyclic, they can only apply to derived environments, if they lead to a change in structure. If they merely add ("structure-building"), but do not change structure, they may apply to an underived environment. Rule ordering is therefore not necessary, and furthermore, MSR and RR can be collapsed into the rule shown in (4), which applies to Swedish as well. The two parts of the FSR can also be collapsed with the Elsewhere Condition: (a) is the specific case and (b) is the general case. Since we do not want an additional rule that assigns feet from left to right, we are left with (4) on p. 3.

3.2. Interaction of length and stress in Swedish

The question of whether Swedish has underlying consonant or vowel length, or possibly both, has long been a favorite with Swedish phonologists (e.g. Linell 1978; Eliasson 1978; Eliasson & LaPelle 1973). I am arguing elsewhere (Schmid, in prep.) that Swedish has underlying consonant length (C_iC_i), based on the existence of analoguous consonant clusters (C_iC_j). Thus, stress rules can only be quantity-sensitive in rimes of the structure VC. Rimes of the structure VV do not exist at the same stratum in which the stress rule applies. As in other IE languages, vowels are lengthened in open syllables. Single consonants are extrasyllabic on the right edge of free morphemes (cf.

Kiparsky 1984 for Icelandic). Vowel lengthening in Swedish applies on cyclic strata, interacting with other cyclical rules.[8] Long vowels and consonants in stressed syllables are in complementary distribution, i.e., VCC or VVC. There are no stressed syllables of the structure VC. In addition, we have to stipulate that final syllable stressing (i.e. the creation of a word-final degenerate foot) occurs in certain marked forms. Whether this is on the level of underived lexical entries, or on one of the first lexical strata is undecided at this point. Heavy final syllables occur in a limited number of suffixes of foreign origin, e.g. -ión$_N$, -át$_N$, -máng$_N$, -ál$_A$, -ént$_A$, -éll$_A$ etc. (see 9 above). A number of foreign suffixes do not produce degenerate feet (e.g. -éray, -órium$_N$, -ábel$_A$), but should be derived on the same stratum for morphological reasons. The foreign derivational suffixes are interesting with respect to the interdependence between the morphology and the phonology and the presence of cyclicity in the lexical strata of Swedish.

3.3. Interaction between morphology and stress

Derivations involving these finally stressed suffixes take place on a non-cyclic, but lexical stratum. Cyclic derivation of words like [social] iz] ation], e.g., in English means that the stress rules apply to the innermost bracket first and then in cycles to every larger bracket. This principle lets us capture the fact that stress patterns are related in words of this sort in that the secondary stress in the derived word often coincides with the primary stress of the source word. In Swedish, cyclical derivations appear to be limited to derivations involving native suffixes and compound formation. I will argue

[8] Alan Prince has pointed out to me that this, interestingly, is in violation of Structure Preservation (Kiparsky 1982b). "Structure preservation" means that lexical rules cannot induce any changes that are not present in underlying representation. Mohanan & Mohanan (1984) have argued that the stipulation cannot be upheld for English and Malayalam in this form either.

that these word formation processes occur on cyclic strata, whereas "foreign" suffixes are added on a non-cyclic stratum. This is not immediately clear, because some of the latter could be derived cyclically as shown in (16):

(16) (a) [politik] er	'politician'	(b) [intressé] ra	'promote an interest'
s w |	1st cycle:	w s w	1st cycle:
\/	Heavy Syll stress	| \ \/	Main stress
w s		\ s	
\/	Word tree	\	Destressing, Word tree
politiker	2nd cycle: Suffix [er]	intressera	2nd cycle:
w s w w	Main Stress	s w s w	Main Stress
\ \/ /		\/ \/	
\ \/	Word tree	w s	
\ s	Pre-stress Destr.	\ /	Word tree
	Stray Syll Adj.	\/	

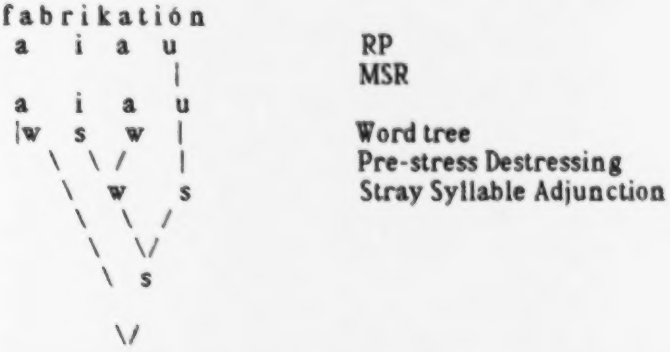
Note, however, that we do not gain anything by deriving these words in a cyclic manner. The stress patterns in politik and politiker are not related (in which case the stress of the latter would be *politiker, which would lead to a stress clash, i.e. two stressed syllables in sequence, which is not permissible in Swedish; equally, *intrèsséra , instead of intresséra). Some words are impossible to derive in a cyclic manner, e.g.

(17)[[[f a b r i k] a t] i ó n 'manufacturing' (fabrik 'factory', fabrikát 'label, brand')

	First cycle
a i	NP
| |	MSR
	Second Cycle
a i a	NP
| | |	MSR
a i a u	Third cycle
| | | |	NP
w w w s	MSR
\ \ \/	Word tree
\ \ s	
a i a u	NP
w w w |	Pre-stress Destressing (applied from left to right)
\ \ \ s	Stray Syllable Adjunction

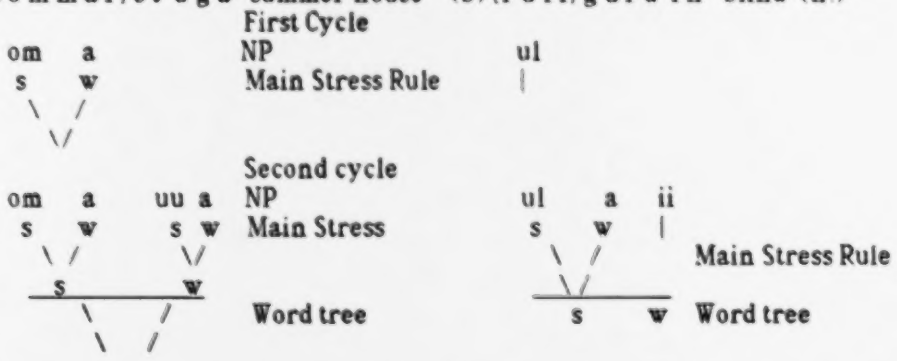
The unpleasant result is a preliminary word tree with four degenerate feet and three subsequent applications of Pre-stress Destressing.[9] With only one application of the stress rules the derivation would look as follows:

(18) f a b r i k a t i ó n



I thus conclude that foreign suffixes are added on a non-cyclic stratum. However, it seems as if cyclicity largely works as a principle in compounds, as is shown in the following examples:

(19a) [s ò m m a r] s t ' u g a 'summer house' (b) [r ù l l] g a r d ' i n 'blind' (n.)



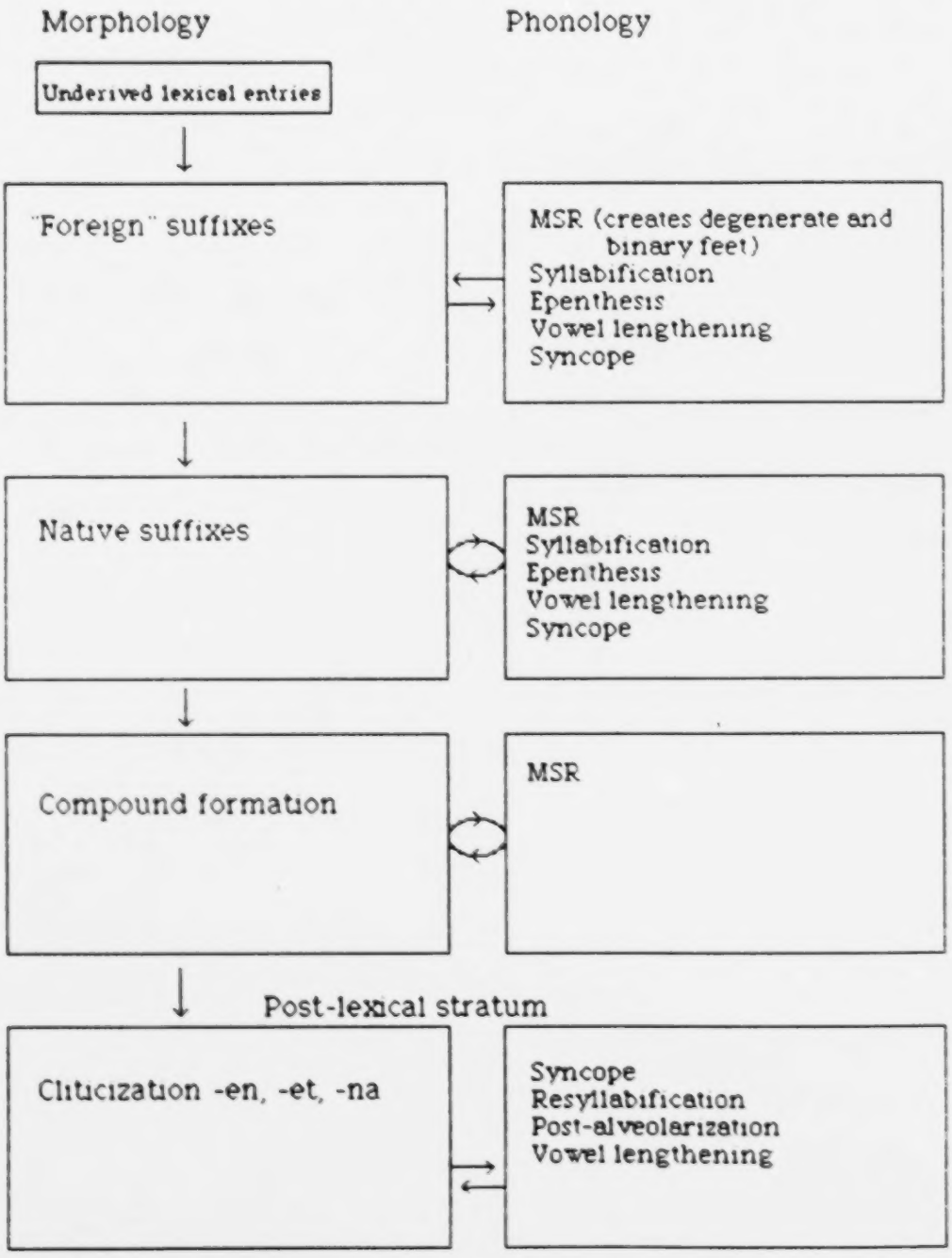
As the examples show, the word tree in true compounds, consisting of free morphemes, is left branching. Clearly, these two word types, derivations and compounds, are assigned stress on different lexical strata. Also notice that secondary stress does coincide with the stress derived on the second cycle. Here is a fundamental difference between Swedish and English, in that the

[9]In English, derivations of this type are handled with the Main Stress Rule which has the power to destroy previous structures, if applied to derived environments.

special compound stress lowering rule (SPE, p. 17), which lowers secondary stress to tertiary stress, does not seem to apply to Swedish. In longer compounds, the last heavy syllable of the last word gets the secondary stress, which means that the Compound rule as formulated by Chomsky & Halle will not work well for Swedish. This point has also been made by Linell et al. (1971) and Witting (1977).

In the preceding discussion, we have seen that stress rules like other phonological rules are intricately linked to the morphology. The preliminary paradigm of the Lexical Phonology of Swedish looks as in Figure 1.

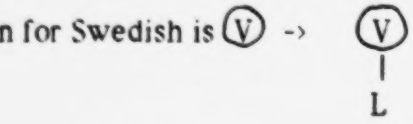
Swedish Lexical Phonology



4.0. The representation of tone accents in Swedish

4.1. Tone accent association

Pulleyblanck (1986: Chapter 5) discusses at length the issue of whether there is a representational difference between tones and tone accents. The result of his discussion (which I cannot do justice to here) is that the diacritic *, introduced by Goldsmith (e.g. 1982: 49)[10], is eliminated in favor of prelinked tones. This allows us to treat accents and tones in a similar manner, and no extra features or stipulations are necessary. Default tones can never be prelinked. Swedish tone accents are not prelinked, but linked by language-specific rules which are dependent on the stress tree.

(20a) The default tone insertion for Swedish is 

(b) In Accent 1 words H is linked to the post-stress syllable.

(c) In non-compound Accent 2 words H is linked to the stressed syllable, followed by a gap, followed by another H syllable. The gap becomes filled with a L tone by default.

(d) In compound Accent 2 words H is linked to stressed syllables. Since a compound can contain maximally two stresses, this gives the right result.

(e) Default insertion applies late and starts applying on the first stratum.

(f) (20a-e) apply on cyclic strata.

H tones are thus linked with stressed syllables as orientation points.

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[10] The diacritic * is an abstract marker, denoting where on the segmental string the association between the autosegment and the segment is to start. The point is derived by language-specific rules (e.g. associating the * with the vowel with [1stress] in English. In addition, we have a string of highs and lows corresponding to the basic intonation contour. The result of the two strings is the accent contour of a word.

These rules are preferable to previous analyses (e.g. Schmid 1985) because

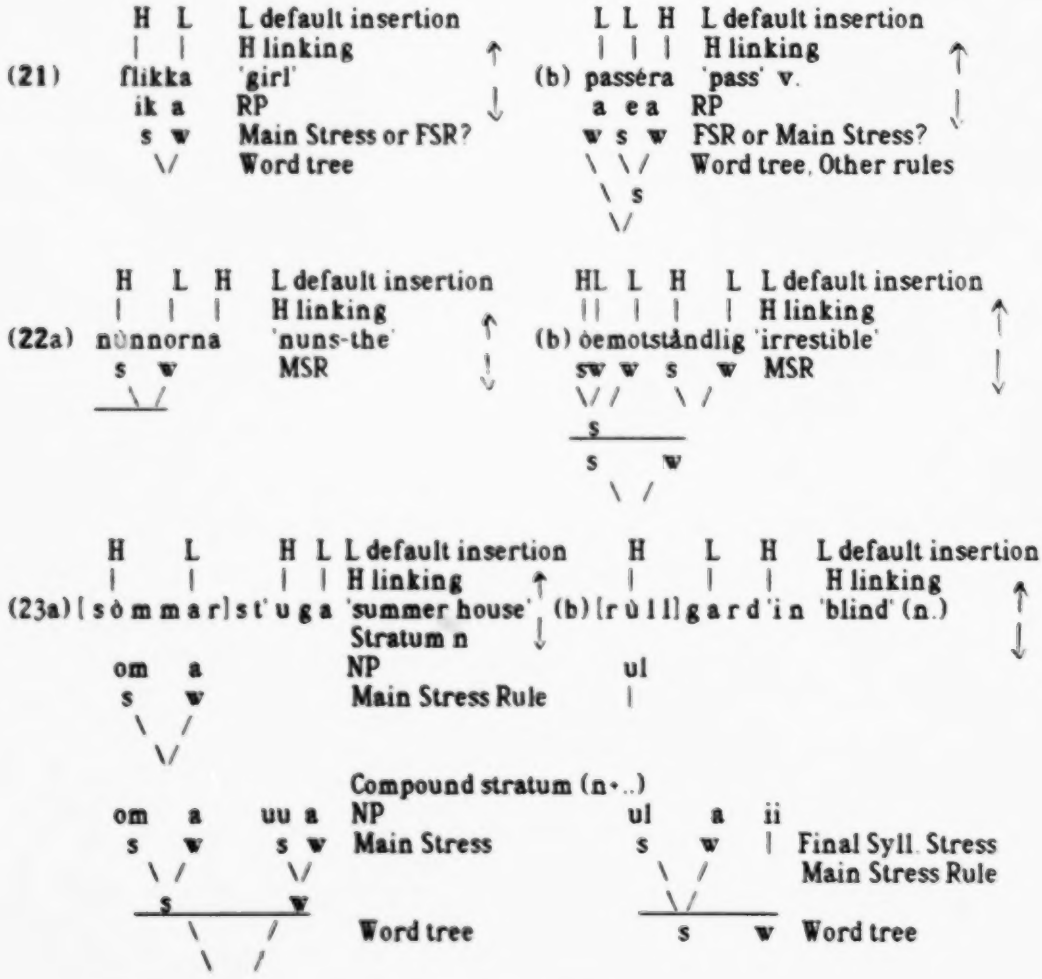
(a) we do not have to stipulate two different contours for Accent 1 and Accent 2 words as primitives;

(b) we do not need to stipulate the presence of a diacritic for the analysis of accents only; but

(c) we can use rules and convention needed for tones, which drastically reduces the number of rules and claims in general.

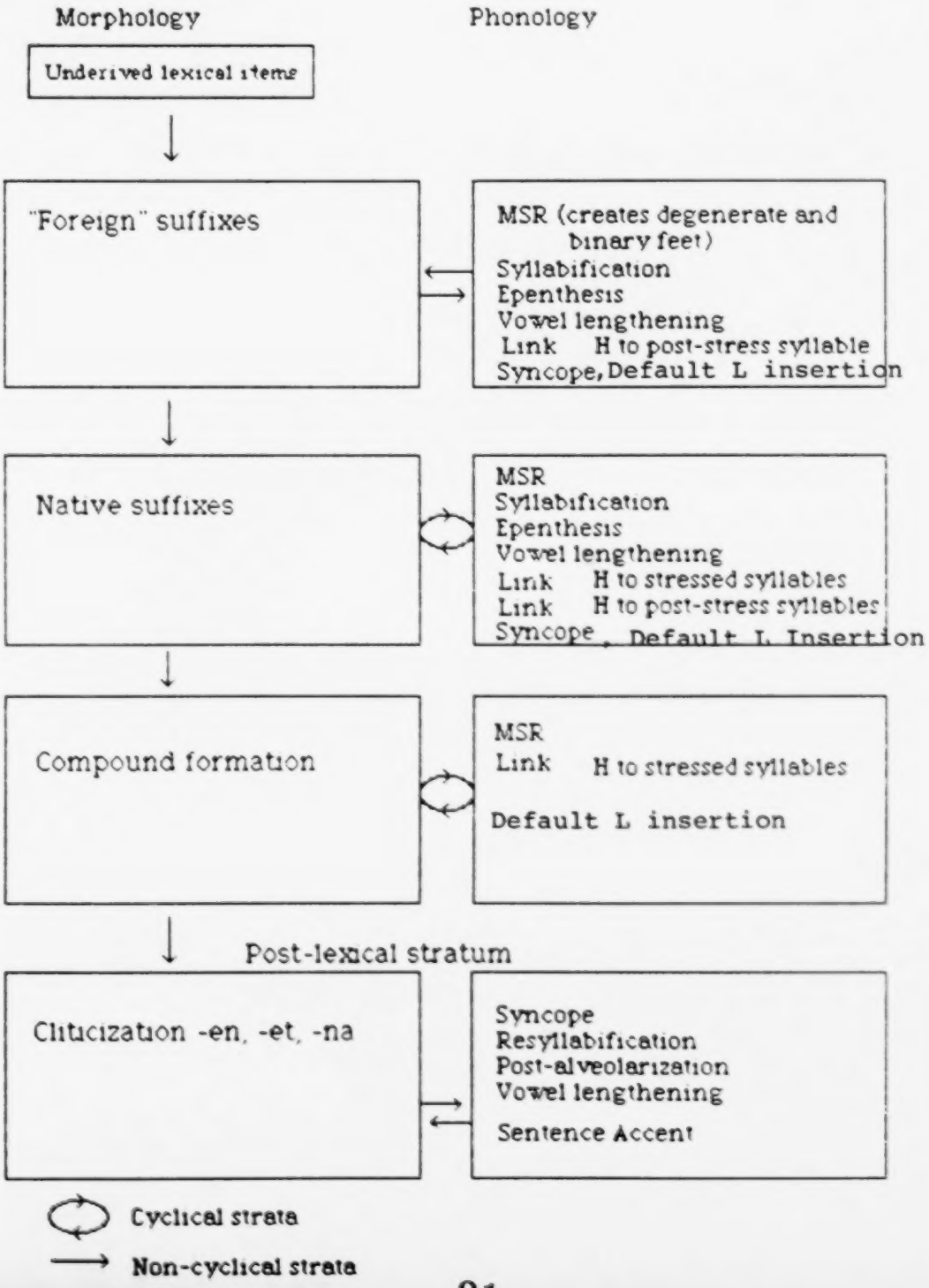
(d) default L-insertion is valid for accents as well as for tones.

Sample derivations:



4.2. Interaction between tone accents, stress and morphology

The interaction between tone accents, stress and morphology is best captured in Figure 2 below.



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